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### NATIONAL BUREAU OF STANDARDS REPORT

**NBS PROJECT** 

NBS REPORT

1002-30-10627

March 12, 1962

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U. S. DEPARTMENT OF COMMERCE NATIONAL BUREAU OF STANDARDS

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#### FIRE ENDURANCE TEST

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#### TWO DULKTRAD ASSEMBLIES

by

# J. V. Ryan and B. W. Bender

#### ABSTRACT

Two bulkhead assemblies were subjected to a standard fire test. The two differed as to thickness of marine board and joint details. Each served as a barrier to flame passage for the required 60 min, but neither prevented excessive temperature rise on the unexposed surface within the initial 15 min.

#### assay sel. Introduction

At the request of the U.S. Coast Guard (letter of 16 January 1962, MMT, JJ/164.008/46), two bulkhead specimens were subjected to fire test in compliance with Subpart 164.008-3(b) of Specifications for Bulkhead Panels for Merchant Vessels.

#### 2. Test Specimens

The specimens were submitted by the Union Asbestos and Rubber Company. The materials were delivered to the National Bureau of Standards where they were assembled by representatives of the submittor. Each specimen, when assembled, consisted of two pieces of Unarcoboard 36 with a vertical joint between, a metal joint member system, and a metal frame. The vertical edges of the marine boards were sanded to a slight taper to prevent a binding fit in the metal components. Details of the assemblies are shown in Figure 1.

Measurements made on each piece of the marine board when received indicated the following:

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#### J. V. Ryon and S. N. Bender

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Messurements made on each piece of the marine board when received indicated the following:

## Manager the resource Average\* Dimensions

Place	Length	vidth	Thickness	Density
Testwe then				15/ft3
Little Lipses	95-31/32	30-1/32	0.747	36.5
2	96-1/16	29-31/32	.741	39.3
	96-1/16	29-15/16	.740	38.6
L hr.4	96-1/16	30-1/32	.741	34.0
	96	29-31/32	.869	36.3
6	96-1/32	30-1/32	*866	37.4
7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	96-1/32	30-1/32	.869	36.2
8	95-31/32	29-31/32	.365	36.6

\*Length and width average of 5 measurements to nearest 1/32 in., thickness average of 15 micrometer readings.

Pieces 1 and 5 were used in the width received; pieces 3 and 7 were cut to 17-1/4 in. width. The marine boards were white and moderately hard.

# 28 min. were across 13. blesteMethodrs of the wide piece of 7/8 in.-thick beard. By 31 min. there were metching craces

The specimens were mounted in two openings of a test frame arranged to permit the simultaneous fire exposure of three bulkheads in the wall test furnace. The third opening was filled with an insulated metal panel.

Care was taken that each specimen was restrained against vertical movement, so that the only relief from thermal expansion would be that provided for in the design and fabrication of the specimens. The peripheral joints between the frame of each specimen and the test frame opening were sealed with a fillet of plaster. This plaster fillet covered all metal on the exposed surface except the vertical joint member between the two pieces of Unarcoboard 36.

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232/32		4	*11.1	AND
36.5	0.747	36/1-08	2£/TE-56	£
	147.	S8\JE-6S	36-1/16	
38.6	ONC.	91/81-63	96-1/16	
34.0	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	30-1/38	91/1-96	
26.3	P06.	28-31/32	96	ŧ
37.4	50 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	35/1-65	96-1/32	à
3.08	ę38.	36/1-08	96-1732	
8-85	780.	28/18-82	95-31/32	

\*Length and width everage of 5 secautements to negrest 1/32 in., thickness everage of 15 electroneter readings.

Firees 1 and 5 were used in the width received; circos 3 and 5 were out to 17-174 in. width. The carine boards were waite and moderately hard.

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Care was taken that each specimen was restrained against vertical movement, so that the only radius from theresi earsnesson would be that erorided for in the design and southerst in the design and the frame of each specimens. This part frame country were sealed with a stiller of plaster. This plaster filler covered all extal on the exposed surface eacest the vertical joint seaper between the two places of Unarcoposit 36.

Eight thermocouples were placed on the unexposed surface of each specimen, distributed as shown in Figure 1. Each thermocouple junction and several inches of its lead wires were covered by a 6- by 6- by 0.4-in. felted asbestos pad. Twelve thermocouples, encased in porcelain insulators and iron pipes, were distributed within the furnace chamber. The furnace fires were controlled to produce average furnace temperatures as close as feasible to those of the standard time-temperature curve of ASTM E-119, which include: 1000°F at 5 min, 1300°F at 10 min, 1550°F at 30 min and 1700°F at 1 hr.

## 4. Results

The test was conducted on February 15, 1962 and witnessed by the following:

Paul Gibson, USCG
David J. Linde. USCG
W. P. Sinclair,
W. H. Dempsey, MA
A. M. LeCompte, MA
R. Wilde
W. L. Hanbury, FFC
A. P. Buquor, Martin Parry Co.

Throughout the test, the flames in the furnace were luminous and well distributed. The first cracks, observed at 28 min, were across the bottom corners of the wide piece of 7/8 in.-thick board. By 31 min, there were matching cracks on the unexposed and exposed surfaces, but the former were very fine and remained so for the rest of the test. There were no further changes and the test was stopped after the 60-minute temperature readings.

Both specimens continued as satisfactory barriers to flame passage throughout the 1-hr test, there having been only two hairline cracks in the 7/8-in. thick specimen and none in the 3/4-in thick specimen. The limiting temperature rise of 250°F, at any thermocouple on the unexposed surface of the marine board, was reached at 10.2 minutes for the 3/4-in board and at 13.7 minutes for the 7/8-in board. The fire exposure severity was 100.2 percent. Additional temperature data are represented in Figure 1.

Right thermocouries were eladed on the unelgosed surface of each specimen, distributed as shown in Figure 1, each thermocourie junction and several indies of its lead wires were covered by a 6- by 4- by 0.4-in. felted asbestos radivelve thermocouries, encased in perceicia insulators and from ripes, were distributed within the furnace chamber. The furnace fires were controlled to produce average jurnace temperatures as close as feasible to these of the standard time-temperature curve of ASTA E-119, which includes 1900°F at 5 min, 1300°F at 10 min, 1500°F at 30 min and 1900°F at

#### ativeeH .4

The test was conducted on February 15, 1962 and witnessed by the following:

Paul Glbson, USCo

David V. Linde, USCo

V. F. Sincistr.

V. H. Dempsey, MA

A. V. Saweers

A. N. LeCompte, MA

R. N. LeCompte, MA

W. D. Hanburg, MY

S. F. Bacutt, Martin Perry C

Throughout the test, the flames in the formess were laminous and well distributed. The first eracks, observed at 25 min, were across the betten corners of the wide siece of 7/8 in.-thick beard. By 31 min, there were matching cracks on the anomaged and exposed entlaces, but the former were very fine and remained so for the rest of the test. There were no further changes and ind test was storted after the court that changes and ind test was storted after the 60-minute temperature readings.

Both speciaces convinued as satisfactory parriers to flame passage throughout the 1-hr test, there having been cally two neighbout the 1-hr test, these speciaca and none in the 1/4-in thick speciaca. The limiting temperature rise of 250 Pr at any thermocouple on the usexposed surface of the marine board, was reached at 10.2 singles for the 3/4-in board and at 13.1 minutes for the 7/2-in board and at 13.1 minutes for the 7/2-in board. The parature severity was 100 2 percent. Additional tenporature data are represented in Figure 1.

#### 5. Summary

The results of the test indient in the tenent of the particular specimens tested as a soulstantory firm barrier for one nour, but that the limiting temperature rise was ranched at 10.2 min for the 3/4-in. poard and at 11.7 min for the 7/8-in. board.

dither the contents of this report nor the ract that the tests were rade at the lational durant of Lightages shall be used for advertising or precotional nurroses.

For the Director

by

A. F. Robertson, Chief Fire Research Section

TG 10230-21:FR3611 Harch 12, 1962 J. V. Ryan Forth of the Co. Is a souther to provide the south of the control of the control







